Five Year Review Report
For
BFI-Rockingham Landfill Superfund Site
Rockingham, Vermont

September 2004

Prepared By:

United States Environmental Protection Agency
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Approved by: **Date:** 9/21/04

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Rockingham, VT

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Executive Summary

The BFI-Rockingham Landfill Superfund Site is located in Rockingham, Vermont. The Site was placed on the National Priorities List in 1989. In 1994, EPA signed an Action Memorandum to initiate a Non-Time-Critical Removal Action (NTCRA). The NTCRA included the placement of a multi-layer cap over the landfill, expansion of existing gas extraction and treatment system, interception of shallow groundwater in a roadside collection trench; and institutional controls. In 1994, EPA signed a Record of Decision selecting monitored natural attenuation and institutional controls as the long-term cleanup approach for the contaminated groundwater. The Site achieved construction completion September 1996. An initial five-year review was performed in 1999. The trigger for this five-year review was the completion of the previous five-year review.

This five-year review documents that the cleanup actions remain protection of public health and the environment. The immediate threats at the Site have been addressed and the remedy will achieve long-term protection when groundwater cleanup goals are met. While institutional controls and the availability of an alternate water supply make future use of the contaminated groundwater very unlikely, there is a concern that the time frame to achieve the groundwater cleanup levels may be longer than the 15 years estimated in the Record of Decision.

Five-Year Review Summary Form

Site Identification
Site name: BFI-Rockingham Sanitary Landfill Superfund Site
EPA ID: VTD980520092
Region: 1 State: Vermont City/County: Rockingham/Windham
Site Status
NPL Status: Final
Remediation Status: Construction Complete with long-term operation, maintenance, and monitoring
Multiple Operable Units: One Remedial Action OU and one NTCRA
Construction Completion Date: 09/26/1996
Has Site been put into reuse: No
Review Status
Lead Agency: EPA
Author Name: Edward Hathaway
Author Title: Remedial Project Manager Author Affiliation: EPA New England
Review Period: 03/23/2004 to 08/31/2004
Date of Site Inspection: 05/11/2004
Type of Review: Post-SARA
Review Number: 2nd
Triggering Action: Previous Five-Year Review Report
Triggering Action Date: 09/29/1999
Due Date for Five Year Review: 09/29/2004

Five-Year Review Summary Form

Issues:

No major issues were identified as a result of the five-year review. The following items have been identified as part of the oversight inspections:

- The sampling methodologies in the sampling and analysis plan should be re-evaluated. If possible, low flow sampling methodologies should be used exclusively. In addition, a consistent sampling methodology should be used for wells with a very low yield.

- Depth to water readings should be taken in tandem with water quality readings in order to monitor drawdown during well purging and sampling activities.

- As specified on page D-20 of the QAPP prepared by Dames & Moore and dated April 1997, groundwater sampling and sample handling activities are to be documented using a field logbook. At the time of EPA oversight inspection, it did not appear that logbooks were used to document the sampling procedures. The sampling contractor should retain a copy of the QAPP and other sampling plans with them during sampling, and that a field logbook be used to document all sampling activities.

- As specified on page D-15 of the above-referenced QAPP, all samples should be preserved immediately after they are taken, or the bottles pre-preserved before sampling to maximize sample integrity.

Recommendations and Follow-Up Actions:

EPA will request that the PRPs address these issues prior to the next five-year review.

Protective Statements:

All immediate threats at the Site have been addressed, and the remedy is expected to be protective of human health and the environment as a result of the institutional controls, alternative water supply, and the restoration of the groundwater to cleanup levels. The remedy is considered to be protective of human health and the environment in the short-term and long-term.

Short-term protectiveness has been achieved because:

- There is no current exposure of humans or ecological receptors to Site related waste above levels that would represent a health concern.
- The landfill cover system prevents exposure to the waste material and contaminants with the landfill.
- The private water line has eliminated groundwater use within the area impacted by the landfill. The small quantity of contaminated groundwater that may be reaching the Connecticut River is rapidly diluted by the flow.
- Landfill gas is collected and treated by the extraction system and enclosed ground flare.
- The land use restriction prevents any use of the land that would result in an exposure to hazardous substances, pollutants, or contaminants.

Long-term protectiveness will be accomplished through continued performance of operation, maintenance, and monitoring activities along with the eventual restoration of the groundwater. A reduction in the cleanup level for arsenic will be necessary prior to the certification that long-term protectiveness has been achieved.

Long-Term Protectiveness:

Long-term protectiveness of the remedial action will be verified through period inspections and long-term monitoring of the contaminated groundwater. The data over the past ten years indicates that the groundwater plume has not expanded. Leachate flow as documented by the leachate collection system has been reduced by over 90% since the installation of the cap. Of the 19 compliance wells identified in the ROD, 11 have successfully achieved the cleanup levels as of May 2004.

Other Comments:

While it is too early to make a determination regarding the success of the remedy, the long-term monitoring data indicates that the groundwater may not achieve the cleanup levels within the 15 year period indicated by the ROD. The next five-year review should address this issue.

1.0 Introduction

A second five-year review was conducted of the remedial actions selected for the BFI-Rockingham Landfill (also known as the Disposal Specialist, Inc. landfill), in Rockingham, Vermont. The purpose of the five-year review is to determine whether the remedy being implemented at the Site remains protective of human health and the environment. The methods, findings, and conclusions of the five-year review are documented in this Five-Year Review Report. In addition, this report presents issues identified during the review and provides recommendations to address them.

This Five-Year Review Report was prepared pursuant to CERCLA §121 and the National Contingency Plan. CERCLA §121 states:

If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that the action is appropriate at such site in accordance with section [104] or [106], the president shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews and any actions taken as a result of such reviews.

The Agency interpreted this requirement further in the National Contingency Plan (NCP); 40 CFR § 300.430 (f)(4)(ii) states:

If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

This is the second five-year review for the Site. The triggering action for this statutory review is the completion of the last five-year review in September 1999. The five-year review is required due to the fact that contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

2.0 SITE CHRONOLOGY

TABLE 1

Date	Event
1960's	Site location used as borrow pit
1968	Disposal Specialist, Inc. landfill begins operation after closure of "Old Springfield Landfill"
1973	BFI of Vermont (BFI VT) acquires Disposal Specialist Inc.
1980	Water supply well installed to serve the facility and adjacent residents
1986-1989	Municipal incineration ash disposed in a lined cell at landfill
1989	Disposal Specialists. Inc landfill is added to National Priorities List as BFI Sanitary Landfill
1989	BFI installs an active gas collection system to limit migration of landfill gas
1992	EPA enters into agreement with Disposal Specialists, Inc. and BFI Vermont to perform site wide investigation
1993	EPA signs first cleanup decision, Action Memorandum, to initiate a Non-Time-Critical Removal Action (NTCRA) to place a cap on the landfill and expand gas collection and treatment system
1994	EPA signed second cleanup decision, Record of Decision, identifying Long-Term Monitoring and Natural Attenuation as the long-term groundwater cleanup approach
1996	NTCRA completed (landfill cap, expanded active gas collection system, groundwater interceptor trench)
1996	EPA enters into agreement with DSI and BFI Vermont to perform long-term monitoring
1999	EPA performs first five-year review

3.0 BACKGROUND

In the early 1960s, the 17-acre BFI Sanitary Landfill (Rockingham) site served as a borrow area for the construction of Interstate 91. In 1973, Browning-Ferris Industries, Inc. (BFI) bought the landfill from an individual who had started operations in 1968. State files indicate that industrial wastes, including heavy metals, bases, pesticides, and volatile organic compounds (VOCs) were deposited in the unlined disposal area from 1968 to 1979. In 1983, Vermont licensed the site as a municipal landfill certified to accept hazardous waste from small quantity generators. The landfill was closed in 1991.

3.1 Physical Characteristics

The Site consists of a 17 acre solid waste landfill and the surrounding areas impacted by the Site. The impacted areas include the overburden ground water, bedrock ground water, and at least three areas of leachate discharge and the associated seep sediments along Route 5. Two of these areas of leachate discharge are now dry as a result of the installation of an interceptor trench. There is a substantial floodplain/wetland area at the base of the steep slopes between the Site and the Connecticut River. There are no wetlands or floodplain areas on the west side of Route 5 within the 25 acre area consisting of the landfill and operating facility. The facility adjacent to the landfill includes an office building, garage, a solid waste transfer station, and storage areas for the transfer station.

The overburden ground water is discontinuous in the area of the Site. Bedrock ground water is the primary drinking water resource for the residences in the area of the Site. A publicly owned sewage treatment works (POTW) is located directly across the Connecticut River in Charlestown, N.H.

3.2 Land and Resource Use

The land use within a one-mile radius of the site is primarily low density residential housing, light agriculture, undeveloped forest land and commercial. Approximately 2,700 people live within 1 mile of the site, and 6,400 residents live within 3 miles. Three homes near the site are supplied water from a water supply line provided by BFI. Natural resources in the vicinity of the site include groundwater, surface water, fish and game, arable land, forest, woodland and minerals.

3.3 History of Contamination

From 1968 until 1991, the landfill received residential, commercial, and industrial solid and liquid waste. Approximately 1.2 million cubic yards of solid waste were disposed of in the landfill during its operation. The landfill stopped receiving waste in November 1991.

Prior to the 1960s, the Site was undeveloped woodland. The Site was used as a borrow pit for construction materials during the 1960's. In 1969, Disposal Specialist, Inc. (DSI) was created by Harry Shepard as the owner and operator of the landfill, and Harry K. Shepard, Inc. performed the solid and industrial waste hauling operations at the Site. Browning-Ferris Industries Inc. purchased DSI and Harry K. Shepard Inc. in 1973; and it continued the operation of the landfill as DSI. That same year the waste hauling business

name was changed from Harry K. Shepard Inc. to Browning-Ferris Industries of Vermont, Inc. ("BFIVT").

The landfill received municipal incineration ash from 1986 to 1989. The municipal incineration ash was disposed in a lined monofill in the southeastern section of the landfill. In 1989, DSI installed an active gas collection system in order to comply with the Vermont air pollution control regulations. The gas collection and treatment system is operated and maintained pursuant to a permit issued by the Vermont Air Pollution Control Division.

The current and future land use of the landfill is considered non-residential due to the impracticality of constructing residences on a closed landfill. The areas surrounding the landfill are considered residential. However, due to steep topography, a significant portion of the area surrounding the landfill is not suitable for development.

3.4 Initial Response

In 1980, the PRP installed a water line to serve the facility and several adjacent residences. In 1989, an active gas collection system was installed to protect the facility structures.

3.5 Basis for Taking Action

A Remedial Investigation and Feasibility Study (RI/FS) was performed at the Site from 1992 to 1994. The RI/FS identified the landfill as the source of contamination in the bedrock and overburden groundwater downgradient of the Site. Table 2 provides a summary of the contamination detected in groundwater. Surface water in the drainages along Route 5 also contained Site related contaminants.

Table 2
Groundwater Contamination Summary

Contaminant of Concern	Average Concentration (ug/l)	Maximum Concentration (ug/l)	Frequency of Detection
2-Butanone	18	370	2/34
Antimony	14	28	1/32
Arsenic	49	282	18/32
Barium	303	1850	30/32
Benzene	6	17	10/34
Bis (2-chloroisopropyl) ether	11	100	1/33
Bis (2-ethylhexyl) phthalate	8	62	10/33
Chromium	5	81	5/32
Manganese	1020	5830	28/32
Nickel	30	102	14/32
Pentachlorophenol	3	3	1/34
Tetrachloroethene	5	12	2/34
Xylene	82	1200	11/34
Vinyl Chloride	4	6	3/34

The information collected during the RI/FS was used to conduct a Human Health and Ecological Risk Assessment. The results of the Human Health Risk Assessment indicate that an unacceptable carcinogenic and non-carcinogenic risk would result from ingestion of bedrock ground water. This is a future use scenario since no individuals are currently ingesting contaminated ground water at the Site. The carcinogenic risk results primarily from arsenic and vinyl chloride. Arsenic, manganese, and antimony all had hazard quotients greater than 1. Arsenic and manganese represented the majority of the non-carcinogenic risk at the Site under both average and maximum scenarios. Compounds which exceed an federal safe drinking water action Maximum Contaminant Level (MCL) or Maximum Contaminant Level Goal (MCLG) in bedrock ground water during any of the five rounds of samples obtained at the Site include: antimony, arsenic, barium, benzene, bis (2-ethyl hexyl) phthalate, chromium, nickel, pentachlorophenol, tetrachloroethene, trichloroethene, and vinyl chloride. In addition to the above chemicals, the State of Vermont ground water standards were also exceeded for 2-butanone, lead, and xylene. The Ecological Risk Assessment concluded that severe adverse effects to the Connecticut River were not likely.

4 REMEDIAL ACTIONS

4.1 Remedy Selection

Two CERCLA cleanup actions have been implemented at the Site. The first cleanup action was a non-time critical removal action (NTCRA), which was described in a 1993 Action Memorandum. The NTCRA included: construction of a multi-layer landfill cap; expansion of the gas extraction system; and institutional controls to protect the cap. The second cleanup action was described in the September 1994 Record of Decision. The second action called for the natural attenuation of the groundwater, continued operation and maintenance of the NTCRA, long-term monitoring, and institutional controls. The 1994 Record of Decision established the following remedial action objectives for the Site:

Landfill (Source Area) Remedial Action Objectives

- Prevent, to the extent practicable, the potential for water to contact or infiltrate through the debris mass;
- Prevent, to the extent practicable, the generation of landfill seeps and the migration of landfill impacted surface water into the Connecticut River;
- Control landfill gas emissions so methane gas does not represent an explosion hazard; prevent, to the extent practicable, the inhalation of landfill gas containing hazardous substances, pollutants, or contaminants; and meet state and federal air standards;
- Prevent, to the extent practicable, the migration of contaminated ground water/leachate beyond the points of compliance by controlling the source of the contamination;
- Minimize the potential for slope failure of the debris mass associated with the multi-layer landfill cap or any future action;
- Prevent, to the extent practicable, direct contact with and ingestion of soils/debris within the landfill and beneath the landfill;

Ground Water Remedial Action Objectives

- Prevent, to the extent practicable, the ingestion of landfill-impacted bedrock ground water exceeding EPA Safe Drinking Water Act Maximum Contaminant Levels (MCLs), Vermont Primary Ground Water Quality Standards, or in their absence, the more stringent of an excess cancer risk of 1×10^{-6} for each compound or a hazard quotient of 1 for each noncarcinogenic compound, by any individual who may use the bedrock ground water within the area of landfill-impacted ground water or within an area that could become impacted as a result of pumping activities;
- Restore the bedrock ground water at the edge of the Waste Management Unit to: MCLs, Vermont Primary Ground Water Quality Standards, or in their absence, the more stringent of an excess cancer risk of 1×10^{-6} for

each compound or a hazard quotient of 1 for each noncarcinogenic compound.

Surface Water (Ecological) Remedial Action Objectives

- Protect off-site surface water by preventing the occurrence of landfill impacted seeps;
- Meet federal and state applicable or relevant and appropriate requirements (ARARs) for any surface water discharge to the Connecticut River; and
- Provide long term monitoring of the surface water and sediments of the section of the Connecticut River adjacent to the landfill to assure that no landfill related impacts occur in the future.

4.2 Remedy Implementation

The design of the NTCRA was initiated in October 1993 and completed in July 1994. The PRP contractor, Dames and Moore, mobilized to the Site in April 1994 to initiate Site preparation activities and install additional gas extraction wells. The gas extraction system expansion and Site preparation activities were completed in May 1994. The multi-layer landfill cap was complete over seventy-five percent of the landfill by December 1994. The remaining twenty-five percent of the mutli-layer landfill cap was complete by July 1995. All surface water control systems were completed by August 1995 and a well vegetated cover was established by October 1995.

EPA, VTDEC, and the oversight contractor performed a pre-final inspection in December 1995 and a final inspection in May 1996. The cap and all related systems were determined to have been constructed according to design and that the vegetative cover was well established. The construction activities and completion were documented in a Completion of Work Report that was approved by EPA in September 1996. This Report documented the completion of the NTCRA and the initiation of Post-Removal Site Control/Operation and Maintenance by the PRPs.

The 1994 ROD called for natural attenuation, monitoring, institutional controls, and maintenance of the NTCRA. No construction activities were required by the ROD. EPA approved the Monitoring Plan for the Natural Attenuation ROD in May 1996. The Institutional Controls were completed in May 1996.

EPA signed a Preliminary Closeout Report (PCOR) for the entire Site (NTCRA and Remedial Action) in September 1996 upon completion of the cap. The PCOR confirmed that no additional monitoring wells or other construction activities were necessary at the Site.

4.3 Operation and Maintenance

The operation, maintenance, and monitoring activities are being implemented by the PRPs. Monitoring and maintenance reports are submitted to EPA and Vermont ANR for review. In addition, EPA has an oversight contractor perform site inspections and oversee the PRP activities.

The operation, maintenance, and monitoring activities focus on:

- the vegetative cover of the cap and repair of any erosion;
- balancing the landfill gas extraction system and repair of any wells or conveyance lines;
- shipment of leachate to an off-site treatment plant; and
- collection and analysis of samples to monitor trends in groundwater concentrations.

5 PROGRESS SINCE LAST REVIEW

This is the second five-year review for the Site. The previous five-year review was completed in September 1999. The routine operation, maintenance, and monitoring activities have continued since the previous five-year review.

6 FIVE-YEAR REVIEW PROCESS

6.1 Administrative Components

EPA, the lead agency for this five-year review, notified VTDEC and the PRPs in early 2004 that the five-year review would be completed. The Five-Year Review Team was led by Edward Hathaway of EPA, Remedial Project Manager, for the BFI Rockingham Landfill Superfund Site, and included staff from EPA's oversight and five year review support contractor TRC Environmental Corporation . Brian Woods of the Vermont DEC was as also part of the review team. The review components included:

- Community Involvement;
- Document Review;
- Data Review;
- Site Inspection;
- Local Interviews; and
- Five-Year Review Report Development and Review.

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6.2 Community Involvement

EPA issued a fact sheet that was mailed to the residents within one-half mile of the Site and made available to the general public at the Rockingham Library. The fact sheet described the Five-Year Review process and how the community can contribute during the review process. EPA held a public meeting to discuss the five-year review process on May 11, 2004. At the meeting, EPA provided an update of Site conditions and interviewed the adjacent residents regarding their perspective of the Site cleanup.

6.3 Document Review

The five-year review consisted of a review of relevant documents including O&M and Long-Term Monitoring Reports submitted by the PRPs, Record of Decision, and Technical Memoranda submitted by the oversight contractor. Applicable or relevant and appropriate requirements (ARARs) in effect at the time of the ROD were also reviewed.

6.4 Data Review

Environmental monitoring data are available for groundwater, surface water and seep samples, Connecticut River, and collected leachate and groundwater. The following sections provide a summary of findings for each media.

Groundwater

Groundwater monitoring has been conducted at the Site since 1994. Groundwater cleanup levels for contaminants of concern in the bedrock groundwater were established in the Remedial Action Statement of Work (SOW) and were to be achieved within 15 years after the completion of the cap (by 2011).

Site monitoring wells are sampled for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals on a biannual basis, as conditions allow. Sampling at a well can cease once concentrations of each contaminant of concern (EPA established cleanup levels) are determined to be below the clean up standard based on the average of four successive sampling rounds (URS, 2004).

To track the progress of the groundwater restoration component of the remedial action, the PRPs are required to provide an assessment of the extent to which the cleanup levels are achieved each five years after the completion of construction. The second five year report will be prepared and submitted in 2005. The Statement of Work (SOW) for the long-term monitoring requires the second five-year monitoring report to demonstrate "a substantial decline (greater than 50 percent or to a level lower than the cleanup standard) in VOC and metal concentrations (except arsenic and manganese) in all bedrock-monitoring wells, which had an exceedence of a cleanup level during the previous 10 years." Arsenic and manganese are not required to meet the 50 percent reduction requirement by the second Five-Year Long-Term Monitoring Report (LTMR) review. All concentrations must drop below cleanup levels by the third Five-Year Report for the natural restoration remedy to be considered successful.

As part of this five-year review, an assessment of the long-term monitoring data was performed to evaluate whether each monitoring well has met the second 5-year review requirement levels for all of the contaminants of concern, a comparison of baseline and recent groundwater concentrations was conducted. The SOW originally listed 19 wells (MW-3, MW-4, MW-6, MW-7, MW-9, MW-10, MW-H27, MW-H28, MW-B3, MW-G25, MW-G26, MW-C17, MW-C18, MW-E23, MW-E24, MW-J37, MW-J38, MW-K39, and MW-K40) with contaminants of concern needing remediation and regular sampling. Attachment K of the SOW lists the baseline levels for each of the contaminants to be monitored for each of the 19 wells. Baseline levels are in micrograms per liter (ug/l) and represent the highest concentration above a cleanup level for each monitoring well based on historic sampling events (1994 and earlier). Attachment G of the SOW provides the reduction levels to be achieved by the second 5-year review. These reduction levels were compared to the most recent sampling results for all contaminants (except arsenic and manganese as previously discussed) reported in the Spring 2004 LTMR prepared by URS Corporation for Browning-Ferris Industries. In addition, concentrations of contaminants exceeding the cleanup criteria in the most recent sampling event (May 2004) have been summarized. Lastly, the concentration trend analyses presented by the URS were reviewed and summarized.

Compliance with Groundwater Cleanup Levels and/or Second Five-Year Review Reduction Levels

The Spring 2004 LTMR was reviewed to identify the contaminants of concern that currently exceed the cleanup criteria. According to the Spring 2004 report, the cleanup criteria have been achieved at 21 compliance monitoring wells for VOCs, and 18 monitoring wells for metals. Note that the Long Term Monitoring Report lists an additional 9 compliance wells in addition to the compliance wells listed in the ROD and SOW. The Spring 2004 LTMR also indicates the cleanup criteria have been achieved for SVOCs at all compliance wells. The May 2004 data indicate that 12 contaminants currently exceed cleanup criteria in 13 monitoring wells. Concentrations of contaminants exceeding the cleanup criteria in May 2004 are summarized in Table 3 (attached). Of the 19 compliance wells identified in the ROD, the following 11 wells successfully achieved required cleanup levels in May 2004: MW-H27, MW-H28, MW-B3, MW-G26, MW-C17, MW-C18, MW-E23, MW-E24, MW-J38, MW-K39, and MW-K40. Eight wells have not yet achieved compliance with the long-term cleanup levels. Of these eight wells, (MW-3, MW-4, MW-6, MW-7, MW-9, MW-10, and J-37), two (MW-6 and MW-7) have not met the 50% decline target specified in the SOW.

Conclusions

Contaminant concentrations have decreased in the majority of the compliance monitoring wells to levels below the cleanup criteria suggesting the remedy is having a positive affect on groundwater quality. Contaminant reduction goals have not been met for some of the wells with continued exceedances of cleanup criteria. Based on the above analysis

of groundwater concentrations at the Site, monitoring wells MW-6, and MW-9 have not yet met the second five-year review reduction targets for all contaminants of concern.

Although the majority of the wells currently meet the cleanup criteria, concentrations of one or more contaminants currently exceed cleanup criteria in 13 of the site compliance monitoring wells. Of the 18 statistical analyses performed in the spring 2004, 10 show no trend (contaminant concentrations are steady) and one shows an increasing (manganese at MW-7). The lack of decreasing trends suggests that the cleanup criteria may not be met at many of the monitoring wells by the third five-year review as required for the natural restoration remedy to be considered successful.

Seep and Surface Water

Seep

Since the installation of the Route 5 Slope Stabilization and Seepage Control System and construction of the landfill cap, only one flowing seep (Seep SW-6) has been identified within the hydraulic influence of the landfill. Sampling in May 2004 verifies that the Seep SW-6 discharge water has and continues to meet stormwater discharge requirements for all constituents of interest since 1995. That May 2004 monitoring event also determined the seep was flowing at a rate of 0.25 liters per minute, well below the 34 cubic feet per second flow rate assumed in the dilution calculation used to establish the discharge criteria. Therefore, it is reasonable to assume less impact to the Connecticut River than originally estimated.

Surface Water

As required by the SOW and Long-Term Monitoring Plan, surface water samples were collected from four locations in the Connecticut River located upstream (RW-4), adjacent to (RW-3 and RW-3A) and immediately downstream (RW-2) of the Site. Samples collected from the Connecticut River continue to meet EPA ambient water quality criteria (AWQC).

Leachate and Collected Groundwater

Leachate generation rates have been monitored since April 1995 based upon hauling records for the underground storage tank (UST) associated with the 1.5-acre ash monofill leachate collection system. Figure 6 of the Fall 2003 Long-Term Monitoring Report presents the average flow rates for the UST in gallons per minute (gpm) using three month averages since April 1995. A decline in the rate of leachate generation since the construction of the landfill cap, completed in June 1995, is evident in Figure 6.

As required in the SOW, a greater than 90 percent decline in water collected by the leachate collection system must be demonstrated by the second five-year review period for this Site. Baseline flow rates were greater than 1.25 gpm in April 1995. As of June 2004, the average flow rate (three month average) was approximately 0.07 gpm, which is

a reduction in flow of greater than 90 percent and therefore successfully meets the second five-year review requirement. In fact, since about 1998 the average flow (<0.1 gpm) has been at least 90 percent less than before the cap was in place.

Leachate evaluation wells include MW-B13D, MW-J35 and MW-J36. A review of the current and historical analytical data reveals that there are no discernable trends associated with these monitoring wells. The 2004 LTMR revealed that the total VOCs associated with samples from the Route 5 system (AST) indicate an overall decreasing VOC trend while inorganic constituents did not reveal a discernable trend.

Groundwater Elevation Contours

Shallow Overburden

Shallow overburden potentiometric contours, constructed from groundwater elevations, show little change between December 1999 and May 2004. The direction of flow remains from Northwest to Southeast.

The groundwater elevation in shallow overburden monitoring wells down gradient of the landfill including MW-B13D, MW-C15, and MW-C16 display a downward trend or have remained constant since installation of the landfill cap. Prior to capping, elevations at MW-B13D ranged from approximately 430.1-434.6 feet above mean sea level (msl). In the period from 1998-2004 the groundwater elevation ranged from 423.5-430.1 feet msl and exhibited several dry periods between Autumn 2001 and Summer 2003. Monitoring well MW-C15 also exhibits, to a lesser extent, a downward trend in elevation. Both before and immediately after installation of the landfill cap, the groundwater elevation ranged to 443 feet msl. In the last six years (1998-2004), however, the groundwater elevation at MW-C15 has peaked at 442.5 feet and 66 percent of the measurements fall below 440 feet msl (compared to 35 percent prior to cap installation). Monitoring well MW-C16 maintains a nearly constant level both before cap installation and over the last five years. Measured groundwater at MW-C16 during these two time periods ranges from 393-396 feet.

For 1998-2004, groundwater elevations in down gradient shallow overburden monitoring wells exhibit a downward trend or remain constant with pre-capping elevations.

Bedrock

The shallow and deeper bedrock potentiometric contours show little change between December 1999 and September 2003. For both shallow and deeper bedrock, the flow is from Northwest to Southeast in the Western portion of the property and from West to East in the Eastern portion of the property.

The data for down gradient bedrock monitoring wells shows no evidence of change between pre-installation and post-installation groundwater elevations.

Landfill Gas

Methane concentrations are measured at the gas extraction wells and perimeter gas monitoring probes on a weekly basis as part of the regular operation and maintenance program. The monitoring information is used to adjust the flow rate at the extraction wells and optimize landfill gas extraction. The data from the gas monitoring probes is used to determine if landfill gas is migrating through the subsurface as a result of a gas management system malfunction. On July 16, 2002, a methane concentration of 33 percent by volume was measured at gas probe VERMMPO3. According to a representative of URS, the condensate collection tank became full and overflowed into the landfill gas header pipe restricting flow. The condensate tank was pumped dry and the adjacent gas extraction wells were opened in an attempt to draw the subsurface gas back into the landfill. On July 23, 2002, the methane concentration was reduced to zero percent at VERMMPO3. No other excursions of subsurface landfill gas migration were recorded.

6.5 Site Inspection

Summary of Current Site Inspection

A site inspection was on May 11, 2004. The site inspection is summarized as follows:

- Overall the landfill cap is in good condition with no evidence of erosion, cracks or slumping. Only one animal burrow was observed during the inspection.
- Differential settlement has been observed in the cap during the semi-annual inspections. The differential settlement does not appear to affect the performance of the cap at this time.
- The landfill gas management system was operating at the time of the inspection. The enclosed flare was operating to destroy the gas and associated contaminants. Most of the gas extraction wells were leaning in a downhill direction. The tilt of the extraction wells did not appear to affect the ability to extract gas as needed to prevent subsurface migration beyond the landfill.
- The surface of the Route 5 groundwater collection system trench was in good condition and water hauling records collected by the PRP indicate the system continues to collect groundwater.
- The site access roads were in good condition.
- The gabion retaining walls located on the east side of the site were generally in good condition with few exceptions. Some tilt to the gabion wall at the southeast storm water detention basin appears to have stabilized. Continued monitoring of the gabion walls is recommended so that any failures can be repaired as soon as practical.
- The storm water drainage swales and detention basins were in good condition and appeared to be functioning as designed.

During the Site inspection, evidence of slope instability was observed on the east side of Route 5 opposite the Route 5 Interceptor Trench. There has been a history of this portion of the road being undermined and destroyed by slope failures.

Erosion was observed during the site inspection adjacent to the Seep 6 outfall. Seep 6 is located near the top of a steep embankment at a roadway drainage culvert on the southeast side of Route 5. An erosion gully (up to 4 feet deep and 6 feet wide, approximately) was previously observed at the top of this slope in 2003. At the time of the May 11, 2004 inspection, the erosion gully adjacent to the road was partially filled with riprap. Erosion below the riprap is still present and appears to be active. The cause of the erosion appears to be related to the concentration of storm water runoff at this point by a recently constructed riprap-lined drainage swale located on the east side of Route 5. The erosion undermined the chain link fence surrounding Seep 6 and is threatening to undermine the drainage culvert and the Seep 6 outlet pipe. The fence surrounding Seep 6 was removed in 2004 based on the low flow from that seep and at the request of the local residents.

Past Inspections

Semi-annual inspections of the BFI Rockingham Landfill have been conducted by the PRPs, EPA (EPA's oversight contractor TRC Environmental Corporation), and Vermont ANR since 1999. There have been no major issues regarding the operation and maintenance of the landfill remedial system. Operations, maintenance, and monitoring have adequately established the landfill cap integrity, leachate collection, and groundwater extraction systems continued operation.

6.6 Interviews

The facility owner, maintenance personnel, and adjacent residents were interviewed as part of the five- year review process. There were no major concerns identified.

7.0 TECHNICAL ASSESMENT

7.1 Question A: Is the Remedy Functioning as Intended by the Decision Documents?

Remedial Action Performance

Evidence to indicate that the remedy is performing as intended include the following:

- The groundwater monitoring data indicate a general reduction in contaminant concentrations since the implementation of the remedy. Concentrations of VOCs and metals in perimeter groundwater monitoring wells have been reduced or remain consistent over the past five years. SVOCs concentrations are below cleanup levels. Based on the groundwater monitoring data collected to date, it appears that the landfill cap has successfully minimized the infiltration of water through the source of the contamination (i.e. the waste mass) thus minimizing the migration of contaminated groundwater beyond the point of compliance. The one exception is the increasing trend of manganese at MW-7. However, this increasing trend is likely the result of a change in the oxidation/reduction potential of the groundwater as opposed to a migrating plume of manganese from the landfill.

- The landfill cap remains intact to isolate and prevent the direct contact with the solid waste contained within the landfill.

- The lack of new seep development at the Site and the apparent low flow of Seep 6 indicate the landfill cap and Route 5 groundwater interceptor trench are effectively reducing the flow of contaminated shallow groundwater that could develop into seeps and potentially impact surface water.

- The reduction in the groundwater elevations near the landfill and the dramatic decline in the flow of leachate from the leachate collection system are both indications that the landfill cap has minimized the infiltration of surface water through the debris mass.

- The landfill gas management system has controlled landfill gas emissions so methane gas does not represent an explosion hazard, and prevented the inhalation of landfill gas containing hazardous substances, pollutants, or contaminants.

- The debris mass and multi-layer cap appear to be stable against slope failure at this time.

While the structural components of the remedy appear to be functioning as intended, the lack of decreasing concentration trends suggests that the cleanup criteria will not be met

at many of the monitoring wells by the third five-year review as required for the natural restoration remedy to be considered successful. A review of the natural restoration component of the remedy will be conducted as part of the next five year review.

System Operations/O&M

Operation and maintenance of the cap, landfill gas management system, leachate collection system, and Route 5 groundwater extraction system has been, and continues to be effective. Issues identified during the semi-annual site inspections are promptly addressed or continue to be monitored as recommended.

The monitoring well network appears to be adequate to define the current extent of the groundwater plume

Several recommendations were developed as a result of a review of groundwater sampling procedures used by the PRP's consultant. The recommendations were previously provided in the September 2003 Oversight Report prepared by TRC dated October 9, 2003. The recommendations are reprinted below:

- The sampling methodologies in the sampling and analysis plan should be re-evaluated. If possible, low flow sampling methodologies should be used exclusively. In addition, a consistent sampling methodology should be used for wells with a very low yield.

- Depth to water readings should be taken in tandem with water quality readings in order to monitor drawdown during well purging and sampling activities.

- As specified on page D-20 of the QAPP prepared by Dames & Moore and dated April 1997, groundwater sampling and sample handling activities are to be documented using a field logbook. At the time of EPA oversight inspection, it did not appear that logbooks were used to document the sampling procedures. The sampling contractor should retain a copy of the QAPP and other sampling plans with them during sampling, and that a field logbook be used to document all sampling activities.

- As specified on page D-15 of the above-referenced QAPP, all samples should be preserved immediately after they are taken, or the bottles pre-preserved before sampling to maximize sample integrity.

Opportunities for Optimization

The five-year review did not identify any areas where changes in the operating procedures would further optimize the cleanup actions.

Early Indicators of Potential Issues

While the physical components of the remedy are in good condition and appear to be functioning as intended, there is a concern that the groundwater may not achieve the cleanup levels in the time period identified in the ROD and CD. The next five years will be a critical time for monitoring and assessment to identify whether cleanup levels will be met or a technical impracticability waiver should be considered.

Implementation of Institutional Controls and Other Measures

Measures to control access include the fencing of the landfill to limit access. A restrictive covenant has also been placed on the property to prevent the use of the contaminated groundwater. No activities were observed that would have violated the institutional controls.

Is There a Need to Update any of the Monitoring Plans used to Evaluate the Performance of the Remedy?

A review of the sampling and analytical procedures was conducted to determine the need to update any of the monitoring plans used to evaluate the performance of the remedy. While the evaluation of the Remedy over the next five years will be critical in supporting an evaluation as to whether the 15 year time frame for restoration is achieved, the program specified in the approved site plans should be adequate to provide the information necessary to determine if the cleanup levels will be met.

7.2 Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of the Remedy Selection Still Valid?

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics

The exposure assumptions used to develop the Human Health Risk Assessment included:

(1) ingestion of groundwater;
(2) direct contact with leachate; and
(3) inhalation of the contaminants from the soil, groundwater, surface water, and leachate by workers or other individuals.

No individuals are currently exposed to contaminated groundwater. With the installation of the alternate water supply, and completion of the landfill cap, leachate collection system, and security fence, exposure assumptions 1 – 3 above have been addressed. The exposure pathways used at the time of remedy selection remain the only pathways of past, current, or future concern regarding the Site. There is no basis to develop additional exposure pathways or risk evaluations.

While there have been some changes to the toxicity data used to develop the human health risk assessment, the cleanup levels are currently at the MCLs that were in placed at the time of the ROD. The MCLs for arsenic has changed since the signing of the ROD. EPA will adjust the cleanup level for arsenic at some time in the future, prior to certifying that cleanup levels have been achieved. Since there is no current exposure to the Site impacted groundwater, the short-term protectiveness of cleanup has not changed. It should be noted that the naturally occurring levels of arsenic in the bedrock in the vicinity of the Site has been shown to exceed MCLs with concentrations of 80 ug/l detected in residential wells not impacted by the Site.

Changes in Standards and To Be Considereds

Applicable or relevant and appropriate requirements (ARARs) were evaluated as part of the 1994 Record of Decision. There have been two changes to ARAR or To Be Considered requirements that were assessed in evaluating the protectiveness of the remedy. The Vermont Groundwater Protective Standards have been revised to be more consistent with federal MCLs. This has no impact on protectiveness since the only change would be the increase in the cleanup level for PCE and manganese. The cleanup level for arsenic was identified as 50 ug/l in the ROD. Subsequent to the ROD, EPA has reduced the federal MCL for arsenic to 10 ug/l. As described above, this change does not impact the short-term effectiveness of the remedy. A reduction in the cleanup level (after consideration for background) may be necessary to certify that the long-term protectiveness has been achieved. The cover system would comply with all current regulations and guidance.

7.3 Question C: Has Any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

From all of the activities conducted as part of this five-year review, no new information has come to light which would call into question the effectiveness of the remedy. No new human or ecological receptors have been identified at this time. No evidence of significant damage due to natural disasters or lack of maintenance was noted during the site inspection. The cleanup level for arsenic will need to be lowered to the level of the new MCL prior to completion of the cleanup action, however, the groundwater is many years away from achieving compliance with cleanup levels. The new arsenic MCL may impact the time period required for cleanup, but it does not effect the protectiveness of the remedy since there is no current use of the groundwater.

8.0 ISSUES

The only issue to be addressed involves the revision of the cleanup level for arsenic to reflect the new MCL. EPA and Vermont ANR will continue to perform periodic

inspections to indicate areas where maintenance may be necessary. The new arsenic MCL will be considered when evaluating the long-term cleanup of the groundwater.

9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

The recommendation and follow-up actions involve the continued oversight of the work being performed by the PRPs to assure compliance with the consent decree and Records of Decision requirements. In addition, several minor items have been identified during the periodic oversight of the sampling activities. These items are:

- The sampling methodologies in the sampling and analysis plan should be re-evaluated. If possible, low flow sampling methodologies should be used exclusively. In addition, a consistent sampling methodology should be used for wells with a very low yield.

- Depth to water readings should be taken in tandem with water quality readings in order to monitor drawdown during well purging and sampling activities.

- As specified on page D-20 of the QAPP prepared by Dames & Moore and dated April 1997, groundwater sampling and sample handling activities are to be documented using a field logbook. At the time of EPA oversight inspection, it did not appear that logbooks were used to document the sampling procedures. The sampling contractor should retain a copy of the QAPP and other sampling plans with them during sampling, and that a field logbook be used to document all sampling activities.

- As specified on page D-15 of the above-referenced QAPP, all samples should be preserved immediately after they are taken, or the bottles pre-preserved before sampling to maximize sample integrity.

EPA will request that the PRPs address these issues prior to the next five-year review.

10.0 PROTECTIVENESS STATEMENT(S)

The remedy is considered to be protective of human health and the environment in the short-term and long-term. Short-term protectiveness is achieved because:

- There is no current exposure of Site related waste to humans or the environment at levels that would represent a health concern.
- The landfill cover system prevents exposure to the waste material and contaminants with the landfill.

- The private water line has eliminated groundwater use within the area impacted by the landfill. The small quantity of contaminated groundwater that may be reaching the Connecticut River is rapidly diluted by the flow.
- Landfill gas is collected and treated by the extraction system and enclosed ground flare.
- The land use restriction prevents any use of the land that would result in an exposure to hazardous substances, pollutants, or contaminants.

Long-term protectiveness will be accomplished through continued performance of operation, maintenance, and monitoring activities along with the eventual restoration of the groundwater. A reduction in the cleanup level for arsenic will be necessary prior to the certification that long-term protectiveness has been achieved.

11.0 NEXT REVIEW

The next five-year review will be conducted by September 2009.

TABLE 3

	Antimony	Arsenic	Barium	Benzene	2 Butanone	Chromium	Manganese	Methylene Chloride	Nickel	PCE	TCE	Vinyl Chloride	Total Xylenes
Cleanup Criteria	**6**	**50**	**1000**	**5**	**170**	**50**	**180 or 900**	**5**	**100**	**0.7**	**5**	**2**	**400**
ROD Compliance Groundwater Compliance Monitoring Wells													
MW-3		271		6.5			304						320
MW-4							6,680						
MW-6		249		8.4			1,880						
MW-7							1,920						
MW-9						452	256		50.2 (a)	9.2			
MW-10										3.9			
MW-B7							952 (c)						
MW-G25		32.8 (a)					2,000						
MW-J37							3,270						
Additional Long-term Monitoring Plan Compliance Wells													
MW-B13D	5.47 (a)	120	46,700	28U (b)	4,500		4,790	79	112	24U (b)	25U (b)	22	
MW-C15							2,230						
MW-D19							2,740						
MW-E22								49					
MW-J35					220 (c)		224	85		1.2U (b)	12	75	

Notes:

ug/L = micrograms per liter

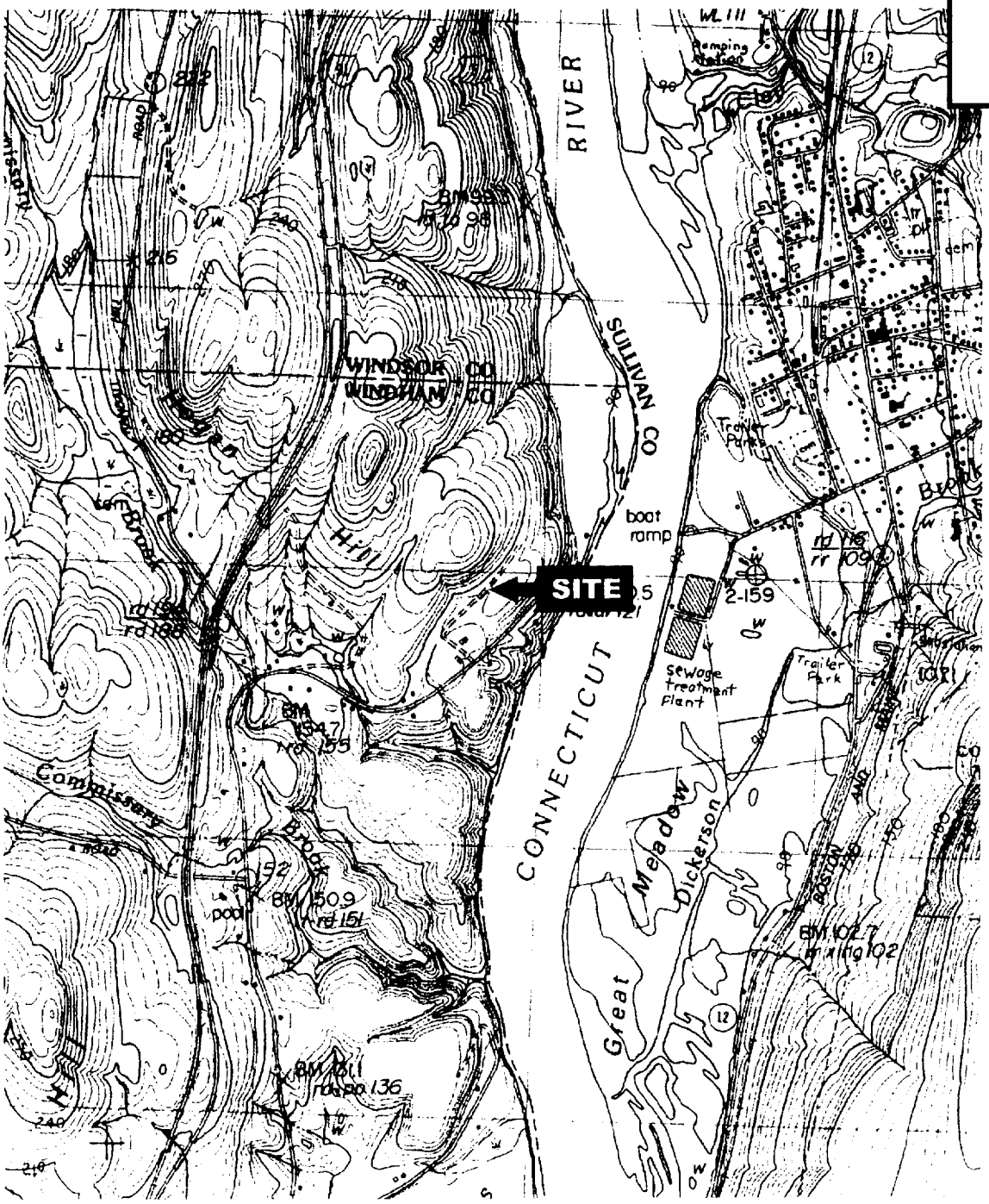
U = Not detected at reported detection limit.

Blank cells indicate the concentration was below the cleanup criteria.

(a) = May 2004 concentration did not exceed cleanup criteria. Average concentration of the last 4 sampling events, greater than cleanup criteria.

(b) = Detection level higher than the cleanup level.

(c) = The May 2004 concentration exceeded cleanup criteria. The average concentration of the last 4 sampling events is less than cleanup criteria.



BASE MAP IS A PORTION OF THE FOLLOWING 7.5' x 15' USGS TOPOGRAPHIC QUADRANGLE: BELLOWS FALLS, VERMONT-NEW HAMPSHIRE 1985

0 1000 2000 3000

scale in feet

FIGURE 1
SITE LOCATION MAP

BFI ROCKINGHAM LANDFILL
ROCKINGHAM, VERMONT

Metcalf & Eddy

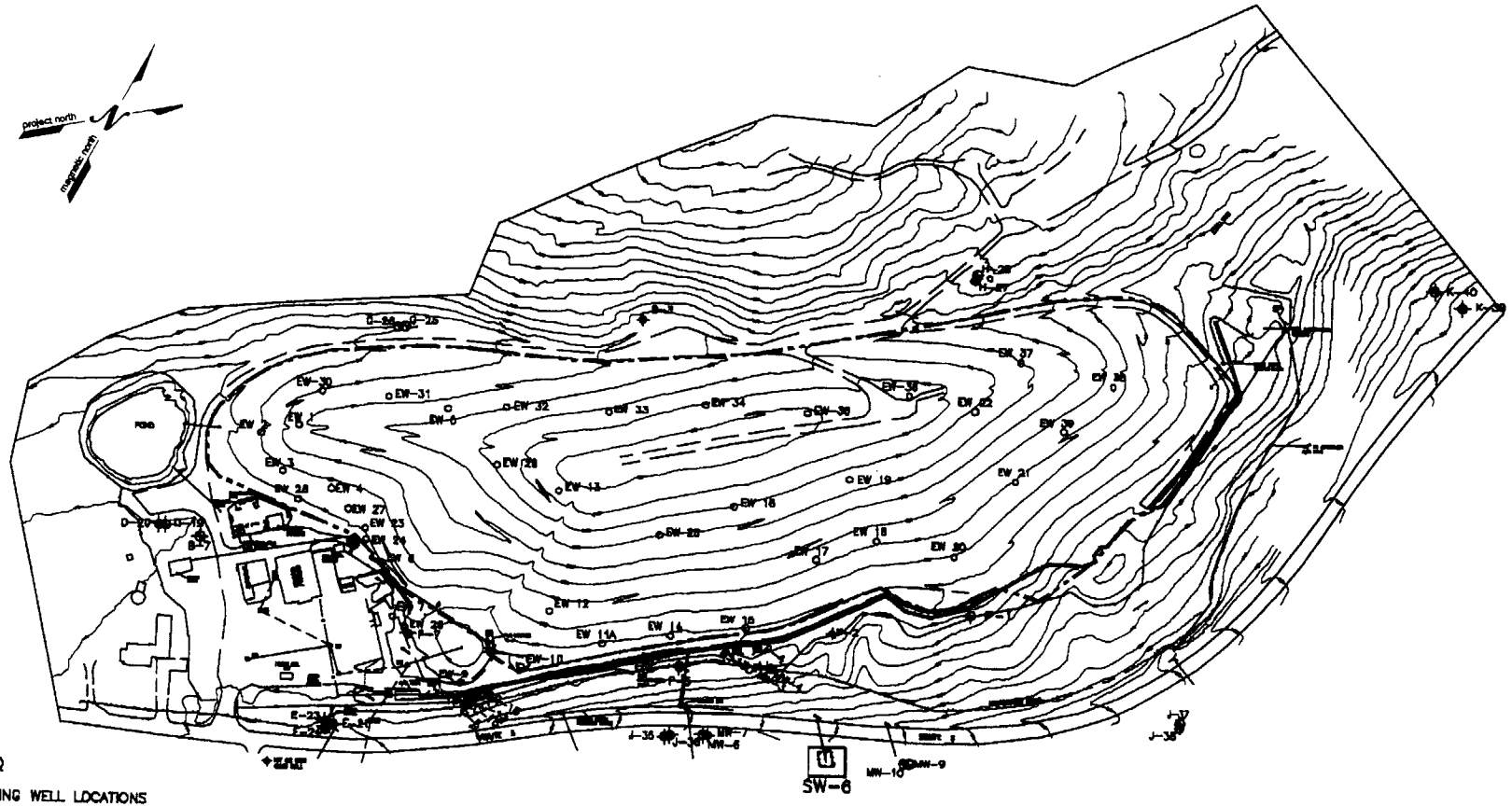
TRC
Boott Mills South
Foot of John Street
Lowell, MA 01852
978-970-5600

TRC PROJ. NO.: 02136-0530-09095

EPA CONTRACT NO.: 68-W6-0042

RAC SUBCONTRACT NO.: 107061

02136/BFI ROCKINGHAM/SITE LOC



LEGEND

MW-1 MONITORING WELL LOCATIONS

EW 17 LANDFILL GAS EXTRACTION WELLS

LANDFILL SOLID WASTE BOUNDARY

0 100 200

Scale in Feet

MAP SOURCE:
SITE PLAN, LONG TERM MONITORING PLAN, MISSING LINK ROAD, ROCKINGHAM, VERMONT.
URS CORPORATION, HALLOWELL, MAINE, AUGUST 1, 2003

02136/BFI ROCKINGHAM/SITE PLAN

FIGURE 2
SITE PLAN
BFI ROCKINGHAM LANDFILL
ROCKINGHAM, VERMONT

Metcalf & Eddy

TRC
Boott Mills South
Foot of John Street
Lowell, MA 01852
978-970-5600

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